NOTES ON THE BAYA WEAVER BIRD, *PLOCEUS PHILIPPINUS* LINN.

BY

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(*With a plate*)

INTRODUCTION

During the past three breeding seasons of the Baya (June/July to September/October 1953-1955), we have kept several nest colonies under fairly close observation and study in the environs of Poona City (Bombay State). The present is merely an interim report of some of our findings, and is published in the hope that other bird students with suitable opportunities for observation and experiment may be enabled to contribute to the meagre knowledge we possess concerning the life history of this common and interesting bird, and allied species of Indian Ploceinae. The field work has been carried out chiefly by V.C.A., a resident of Poona, under the advice and direction, and with the intermittent participation of the senior author.

A broad outline of the breeding biology of the Baya was originally published by Sálim Ali in 1931 (*JBNHS*, 34: 947-64). A large amount of confirmatory evidence has accumulated since, and it now seems reasonable to consider the basic pattern as established. However, many fundamental facts regarding the life and movements of the Baya in the non-breeding season, and precise statistical data relating to its nesting behaviour were, and still are, completely lacking, and the object of our investigations has been to collect as much further detailed information as practicable.

One of our major handicaps so far has been the impossibility of studying the same colony uninterruptedly from the commencement of the breeding season right through to the end. The most populous and easily controlled colonies in the Poona area are usually those built around irrigation wells situated within the various 'wādis' or market gardens. Owing to the damage bayas do to the surrounding bajra and jowar crops, the farmers are in the habit of pulling down all accessible nests from time to time. These holocausts usually take place just when a colony is at the peak of activity, namely when the majority of the eggs have hatched. It is disconcerting to find one's observations suddenly broken off thus, often at the most crucial stage. We have been compelled, on this account, to divide our attention between several widely scattered colonies, and to piece together bits of data collected as opportunity offered.

Another difficulty which has seriously hampered our work and prevented the procurement of unequivocal data concerning individual birds in a breeding colony is the want of a workmanlike technique for marking nesting bayas without catching them and thereby possibly upsetting their normal behaviour patterns. Yet for statistical precision

it is obviously essential that individual birds in a colony, at least the control ones, should be unmistakably identifiable.

Squirting liquid dyes on to the bird with a water pistol was unsuccessful, since the jet, apart from being too thick and conspicuous, was not of sufficient velocity to reach the bird before it could move away. Latterly we have used a large hypodermic syringe, such as is employed for inoculating cattle, which, discharged from within an observation hide at the range of a few feet, has given better promise. The jet is finer and more powerful, carries a longer distance without spreading out too much, and its trajectory can be controlled. The larger capacity of the barrel enables the aim to be corrected while the jet is in action, without alarming the bird unduly.

In squirting liquid dyes the object is to mark a bird while it is clinging to its nest, so that both bird and nest get sprayed simultaneously, making them thereafter readily recognizable as belonging to each other. It is only by marking in this manner that the social behaviour and inter-relationships of individuals within a colony can be satisfactorily studied. The aniline dyes used in the 1954-55 experiments were crimson, green, yellow and blue. We are grateful to the German dye manufacturing firm of Cheka Ltd. of Bombay, for their interest in the problem, and for their valuable advice and generous co-operation.

Marking Bayas.

During the breeding season, when recognition of individuals within a colony is of the utmost consequence, it is not easy to devise a technique that will enable catching of the birds at the colony without disturbing their normal behaviour and rhythm. For males, the only feasible method seems to be to spray them with quick-drying liquid dyes, fast to rain and sun, which will identify them at least until the post-nuptial moult; therefore, throughout one complete nesting season. But it is also desirable that the males should be marked in some more permanent manner so that their migratory local movements and their inter-flock behaviour during the off season, and their colony-forming and sexual activities on the approach of the next breeding season can be properly studied. For catching the males at a colony for ringing, we have as yet found no practicable method.

However, accidentally we hit upon a successful method of catching nesting females for marking with dyes as well as with coloured and aluminium rings. While incubating, and for the first 6 days or so after the eggs hatch, the female sleeps in the nest at night. The slightest jerk to the nest after dark causes her to slip down the entrance tube and make off in a flash. We found that a butterfly net held quietly over the mouth of the tube, before the nest is touched, secures the escaping female without difficulty. In the same way it it possible to secure, during daytime, full-fledged young that try to escape from the nest prematurely on its being handled.

How and why a particular tree, or group of trees, is initially selected from amongst others which to all appearances are equally suitable, is a moot point. Once a nest colony has been established, however, there is no doubt that the old nests, or their battered

remnants, serve to attract the birds in successive seasons. We know colony sites that have been in yearly occupation for at least 30 years, and they doubtless continue longer under the requisite conditions. Even after the periodical wholesale destruction of the colonies by the local farmers, the birds resort to their traditional nesting sites year after year. Whether, and to what extent, the members of one particular colony return to the same spot in successive years, and to what extent, if at all, the young return to their birthplace for nesting, in what manner and on what pattern dispersal of the young occurs, whether some males and some females (or all females?) breed in their first year, and the factors that alter the sex ratio by the time the birds become adult, are some of the points which challenge investigation.

One striking feature about the colonies is the definite limit to which an individual colony seems capable of expanding. The number of nests in a colony remains more or less constant from year to year so that there is apparently some factor or factors that govern annual fluctuation of numbers, and also control expansion above an optimal upper limit. That some colonies are larger than others is, as far as can be observed, not due to progressive annual growth: thus a colony containing, say, 60 completed nests will hold approximately the same number year after year. Small colonies are more apt to be abandoned (i.e., they are of a more 'shifting' nature) than large, old-established ones which presumably began as large colonies in the first instance.

From the data collected it appears that, although a few isolated females become physiologically mature and begin laying in some of the earliest nests, the majority of females arrive much later, at all the scattered colonies in the area more or less simultaneously, in search of eligible nests. They come, as it were, in a great wave or irruption, all in a matter of a couple of days. The exact period of such irruption, in a normal monsoon, is between the latter part of July and the third week of August, as soon as the weather breaks after several days of heavy and continuous downpour. During such wet spells there is a lull in the building operations of the males, to be followed by a spurt of intense activity immediately drier weather intervenes. Accompanying these feverish building activities is a good deal of excited flapping and fluttering of wings, and loud lively choruses which can be heard over enormous distances in the countryside, and which no doubt serve to orientate the prospecting females. Thus the larger colonies, by virtue of their louder vocal advertising, have an advantage over the smaller and less noisy ones. It would, therefore, be of advantage for smaller colonies to be built close to large ones, and this, in fact, is very often the case.

The arrival of sexually mature females *en masse* ensures the virtual synchronization of laying and hatching. The chicks also leave the nests more or less simultaneously—perhaps within the span of a week or so. The colony, thereafter, becomes silent and deserted except for an odd belated nest or two in which the females alone continue to feed the young. These foraging females are now very shy and circumspect, usually flying up rather surreptitiously straight into the nest, and away,

with no tell-tale loitering. The change in their behaviour is due, no doubt, to the removal of the collective vigilance of the colony.

Apparently the flock instinct is so strong that in a few nests in almost every large colony one may actually find an entire clutch of partly incubated eggs, or even a mummified brood of nestlings which have been abandoned to their fate by the parents in their hurry to leave the colony with the rest of the birds. The frequency with which such abandoned nests are found at the tail end of the season, particularly in the larger colonies, leaves little doubt as to the circumstances.

The peak period of the nesting activities synchronizes with the progressive ripening of the adjacent jowari crops upon which the adults and freshly launched young so largely subsist, and to which they cause such considerable damage.

In the earlier stages of a colony, before the main body of prospecting females arrives ('pre-irruption' period) there is naturally much greater competition and rivalry among the individual males for winning the few hens that are ready to nest. The felonious practice of cutting down the nests of rival cocks, while the owner has gone to fetch building material, is much more in evidence during the earlier stages of nesting than after most males have secured mates and are occupied in further building. Whether the early breeding females are double brooded, i.e., whether they raise a second family during the same season, remains to be shown.

Eggs are laid at 24-hour intervals, in the early morning. Incubation apparently starts from the second egg, and takes 14-15 days. Full-fledged young leave the nest 13-14 days after hatching. The female occasionally feeds them outside at first, but they mostly fend for themselves.

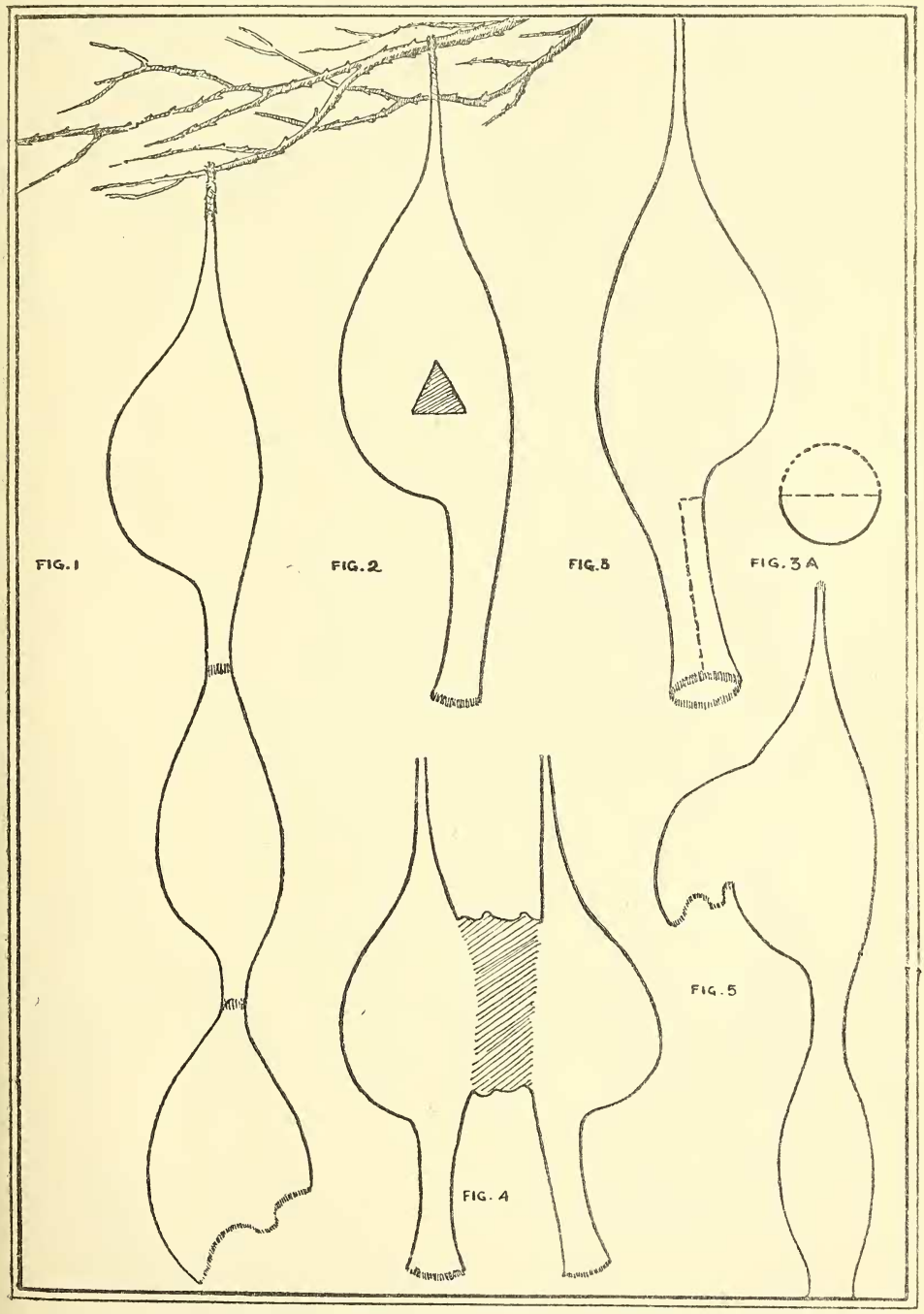
Sex Ratio.

The sex ratio of adults in the colonies is found to be invariably 2 females (occasionally 3) to 1 male. This has been ascertained by repeated counts and rechecking of completed, occupied nests, and of the working males.

A normal brood in the Poona area consists of 3 or 4 young. It is desirable, therefore, to determine whether this disparity in the sexes is present from the time of hatching, or comes about at a later stage possibly due to some mortality factor selective against the males. We hope to devote special attention to this problem during the 1956 season.

Abnormal Nests:

Abnormality in the structure of baya nests takes a variety of forms. The commonest and most frequent one is the double or 'tandem' which consists of one nest suspended from the end of the entrance tube of a completed upper nest. Occasionally it may be a 3-storeyed affair with the middle nest in different stages of completion. Two adjacent nests are sometimes conjoined exteriorly by a woven fabric, and in other ways. Some types of abnormal nests are shown in the plate. In all examples of double or triple nests, we found only a single chamber—the last built—to be in current use, the others being blocked



Figs. 1, 4, 5. Abnormal baya nests.
Figs. 2, 3. Experimental mutilations.

up and unoccupied. In most cases, however, the lowest nest remained unfinished. We have found no suggestion that such multiple nests were ever intended for contemporaneous habitation, e.g., by a 'harem', or that it may be an experiment in 'apartment housing'—the rudimentary beginnings of a composite community-nest as in the Sociable Weaver (*Philetairus socius*) of Africa.

In all the closed-up and sealed-off chambers of the multiple nests examined by us, there has invariably been evidence of some disaster to the contents. Such evidence usually consisted of dried matted yolk or cracked eggs—the result of some accident or felony(?). In one case a desiccated chick, perhaps 5 days old, was found partially but deliberately buried (woven over) in the fabric of the lining of the egg chamber, as the damaged contents usually are.

It seems obvious that the hyperstructures to a normal nest are added by the original builder himself. But whether the second chamber, if occupied, is by the original female or a different one, needs to be determined. When two completed, occupied nests hanging side by side are conjoined into one unit, it is definite proof that they both belong to one and the same individual, since no cock baya will tolerate a neighbour or stranger tampering with his property.

As a result of our observations it can unreservedly be stated that W. Jesse's account (*Ibis* 1897, p. 558) of a 7-storeyed nest is inaccurate, especially in regard to the storeys being added year after year. The last 3 chambers in this nest are said to have contained 3, 3 and 2 eggs respectively. If this is to suggest that these chambers were in contemporaneous occupation by 3 different females — e.g., in the nature of an apartment house or a 'block of flats' — then the statement is open to serious doubt. Baya nests are strictly annual structures; they are built afresh each season, the remnants of the previous year's nests being torn down to make room for the new ones. We have not found any evidence that the same nest is ever used in a second season.

V.C.A. recorded one double-storeyed nest in which the sealed-off upper chamber contained 4 *fresh* and apparently undamaged eggs, while the lower chamber was at the early 'pre-bell' or 'helmet' stage. In this case it is conceivable that the female concerned had, for some reason, deserted the nest (maybe killed?). And since cock bayas do not incubate, the owner commenced adding the lower nest in order to attract another hen. When the eggs in a nest get accidentally broken the hen naturally deserts the nest, whereupon the male seals it off and often adds a lower chamber. In the above case, since the eggs were undamaged, the female may have failed to turn up for a different reason.

Intelligence.

In earlier field work, in order to inspect the contents of controlled nests in a colony, S.A. had cut a vertical incision in the woven fabric opposite the egg chamber. On visiting the colony again on the following day he had observed the incision to be neatly darned with fresh green strips of grass, producing the appearance of a zip fastener. Repairing such incisions in this clever manner is so foreign to what the bird would ever be called upon to deal with under natural conditions, that the behaviour suggested something higher than a purely

instinctive reflex. At the suggestion of Prof. Bernhard Rensch of Münster we therefore planned a series of experiments to test the extent of the baya's capacity to deal with unaccustomed and unnatural situations. Windows of various shapes and sizes—round, oval, square, rectangular, triangular etc.—between 1 and 2 inches across, were cleanly cut out with a pair of scissors in the walls opposite the egg chamber of selected nests. Only nests containing chicks were used for these experiments in order to minimize possible desertions. The windows were usually cut in the forenoon while the female was away foraging. On return with food for the young, the usual reaction of the hen to this sudden transformation in her abode was, curiously enough, one that can only be described as indifference; there was certainly no perturbation on her part, though sometimes she did seem mildly puzzled.

In one instance the hen flew up the entrance tube of her nest, as usual, and fed the chicks apparently before she realized that there was anything amiss. After feeding, she poked her head out of the newly erupted window, looked surprisedly this way and that, and actually made her exit through the opening. She clung to the nest above the window, head downward, peering within through the opening repeatedly, and 'nibbling' at the jagged edges. The bird then flew off but returned 5 minutes later, again clung outside the nest, peered into it repeatedly, and tugged undecidedly at the loose ends. She then hopped across to a neighbouring half-built nest, but made no attempt to pull out any strips from it for the repair; she then hopped back on to her own nest behaving in the earlier inane fashion for another 5 minutes or so. She flew off once more and returned 20 minutes later with a soft white contour feather of some bird in her bill. Employing the same technique as she would in lining the egg chamber, she attempted ineffectively to block the hole by pressing the feather on the jagged rim. After this token repair the bird flew off. She returned 10 minutes later with food for the chicks. Instead of flying up the entrance tube, she now clung to the outside of the nest and, in quite a matter-of-fact manner, passed the food to the chicks through the window, like a flowerpecker!

Thereafter she removed the feather from where it had been pressed in, and tried refixing it at several different points. It was quite obvious that not being familiar with the weaving technique she was completely at a loss about how to set about repairing the damage.

During all this interval the cock was nowhere to be seen. One cock, perched on a bush 3 ft. away, seemed completely unconcerned and presumably was not the owner of this nest.

In the above case, as in the many others experimented with, the damage was found fully repaired when the nest was visited again about 9 o'clock next morning, although usually by sundown the previous evening there had been no sign of activity from the cocks in this regard.

In a second nest, containing 3 well-grown young, a triangular window was cut with $1\frac{1}{2}''$ base and $2\frac{1}{2}''$ sides (fig. 2). When revisited at 10 next morning there was a flimsy woven criss-cross triangular mat of green grass strips covering the hole, fixed to the nest along two sides

of the triangular window, but loosely flapping along the third side. The mat looked as though it had been prepared separately and then fixed *in situ*! The repair was uncompleted.

Square, rectangular and oblong windows were all darned over with equal speed and skill, suggesting a degree of true intelligence quite above what is ordinarily conceded to the average bird.

In one nest the entire entrance tube was snipped off from its base, at the level of the egg-chamber. By 10 o'clock the following morning, 3 inches of the tube, in the form of a collar, had been rebuilt with fresh green grass strips. All fresh repairs stand out prominently, even at a distance, by contrast with the yellowish brown colour the nest has acquired after many days of exposure to the sun.

The cleverest repair, in our opinion, was where the entrance tube had been transversely bisected or slit all along its length leaving merely a vertical channel on one side (fig. 3). By next morning the mutilation had been repaired by the addition of the complementary half channel, thus restoring the original circular tube. The speed and neatness with which this intricate repair was executed, and the precision with which the new half was curved and channelled were quite remarkable.

All repairs, in every case, were made entirely by the cocks who normally started serious work on them soon after daybreak on the following morning. On one or two occasions we found a few strips of the darning already in position the same evening before the males left for their nightly roosts.

In one case the hen flew up the tube with food for the chicks as usual, but promptly went out through the round window again, flying up the tube a second time and repeating the window exit, as if trying to believe her eyes! But later, through the rest of that afternoon, she freely used the window for her exits after feeding the young. The cock, who was actively employed on a second nest near-by which a second hen was prospecting, paid no attention to repairing the damage despite the fact that from time to time he alighted on the mutilated nest and had obviously realized that repair was necessary. By noon on the following day, however, he had completely repaired the hole. To observe further reaction, this repaired patch was excised a second time leaving the round open window as before. The cock visited the nest several times thereafter, but did not commence repair work till 75 minutes later, bringing fresh green grass strips as his darning thread. The repair work was fitful since the cock's attention was diverted by the new hen of his second nest whose frequent comings and goings caused him to leave off and give amorous chase. It was clear that just then he was more concerned about the new hen than about repairing his damaged first nest. In spite of the interruptions, however, the repair was fully completed in 2 hours after commencement.

V.C.A. has recorded that when he excised the newly repaired patch he left the round wad of woven strips lying on the ground below the nest. He was surprised to see that, after completing the repair the second time, the cock picked up this wad and attempted to utilize it as such on the second nest which was as yet unfinished. He tried to fix the wad into this place and that, but finally jettisoned it!